DESCRIPTION

Apparatus and Method for Winding Wire

TECHNICAL FIELD

The present invention relates to winding of a wire such as electric wire or optical fiber and in particularly to an apparatus and method for winding a wire, which treat a cut terminal portion of the wire when it has been wound at high speed.

BACKGROUND OF THE INVENTION

Conventionally, when a wire such as electric wire or optical fiber which is continuously fed is wound on a take-up bobbin at high speed, switching of winding of the wire from the take-up bobbin which has finished the winding of a given length of a wire to an empty take-up bobbin which newly begins the wire winding is conducted without interrupting the running of the wire. Fig. 1 is a view explaining a conventional treatment of a cut terminal wire on completion of the winding of the wire. In the drawing, reference numeral 1 denotes a wire; 1a a cut terminal wire; 1b a wound wire; 2 a traverse roller; 3, 3' take-up bobbins; 3a a collar; 3b a core; 4 a catcher wheel; 5 a linearly movable arm; 6 a catcher; and 7 a cutter.

When the take-up bobbin 3 on the right side has wound a given length of the wire in a counterclockwise direction in Fig. 1, an empty take-up bobbin 3' is rotated clockwise and the traverse roller 2 for guiding the wire 1 is moved to a left side position as shown in the drawing for switching over to winding the wire on the left empty take-up bobbin 3'. The wire 1 is shifted so that it is tangent to the core 3b of the empty take-up bobbin 3' and then the wire 1 is moved toward the catcher wheel 4 side which is provided on one of the collars 3a of the take-up bobbin 3' by moving the linearly movable arm 5 in the direction of the arrow in the drawing.

The catcher 6 on the catcher wheel 4 is engaged with the wire 1 to retain it so that the wire 1 is cut by means of a cutter 7 due to continuous rotation of the take-up bobbin 3'. Thereafter the traverse roller 2 and the linearly movable arm 5 return to their original positions and winding of the wire 1 on new take-up bobbin 3' is started. On the other hand, the rotation of the bobbin 3 on the fully-wound side is stopped. However, the take-up bobbin 3 can not immediately stop its rotation due to its inertia, and the bobbin 3 continues to rotate even though its rotation speed decelerates to some extent.

At this time, with the rotation of the take-up bobbin 3, the cut terminal wire 1a is swung around the periphery

in a free state. Thus, the cut terminal wire 1a will impinge upon the peripheral obstacle or the projection and bound against the wound wire 1b and so-called wire whipping on the surface of the wound wire 1b may occur. This whipping on the wound wire is also caused due to the release of the tension of the wire. This wire whipping will give remarkable damages to the wound wire when winding is conducted at high speed. In particular if the wire is an optical fiber, the wound optical fiber may be broken into segments. Hence the wound optical fiber should be discarded, resulting in a waste of cost.

As a countermeasure for preventing the wire whipping, a winding apparatus comprising a take-up bobbin with a terminal wire entry ring at one of its collars for accommodating the cut terminal wire on completion of the wire winding is known (see, for example, Patent Document 1: Japanese Laid-Open Patent Publication NO. H09-108734). Fig. 2 is a view explaining the summary of the winding apparatus which is disclosed in the above-mentioned Patent Document 1. In the drawing, a reference numeral 8 denotes a drive shaft; 9 a pressing cone; 10 an entry ring; 11 a bobbin cover; 11a a cover side edge; 12 a guide groove; and 13 a terminal wire guide plate. Since the other reference numerals which are identical to those in Fig. 1 denote identical parts, the description thereof will be omitted.

The drive shaft 8 is provided with the catcher wheel 4 so that the catcher wheel 4 is rotated together with the drive shaft 8. The catcher wheel 4 is fitted to one of the collars 3a of the take-up bobbin 3. The take-up bobbin 3 is mounted to be rotatable on the drive shaft 8 by pressing the pressing cone 9 from the other side. The entry ring 10 is irrotationally mounted on the side in which the take-up bobbin 3 is mounted on the drive shaft 8 so that the entry ring 10 encloses the catcher wheel 4 and the collar 3a. The entry ring 10 comprises an outer peripheral wall 10a having a uniform diameter; an opening having an annular wall 10b which slightly extends in an inner radial direction on the bobbin side; and an outer side wall 10c which is substantially closed.

A semispherical bobbin cover 11 is disposed so that it covers a lower half of the take-up bobbin 3. The cover side edge 11a on near side (entry side of the wire 1) of the bobbin cover 11 is formed with the guide groove 12 adjacent to the entry ring 10. The bobbin cover 11 is provided along the inner periphery thereof with the terminal wire guide plate 13 having a predetermined height, which gradually approaches toward the entry ring 10 in a direction from the cover side edge 11a to the opposite side edge.

By forming the structure mentioned above, the cut terminal wire 1a is regarded as going into the guide

groove 12 due to the rotation of the take-up bobbin 3 and being prevented from moving at the cover side edge 11a, followed by entering the entry ring 10. If the cut terminal wire 1a is disengaged with the guide groove 12, the terminal wire guide plate 13 will enable the cut terminal wire 1a to be responsibly introduced into and accommodated in the entry ring 10.

Patent Document 1: Japanese Laid-Open Patent Publication NO. H09-108734

DISCLOSURE OF THE INVENTION

However, even if the winding apparatus is formed as shown in Fig. 2, the outer peripheral wall 10a of the entry ring 10 has a uniform diameter and the opening is made relatively larger. Accordingly, there is the danger that the cut terminal wire 1a which has been accommodated in the entry ring 10 once springs out of the entry ring 10 again. Moreover, the necessity of other device such as bobbin cover 11 increases the size of the apparatus.

The present invention was made in view of the above-mentioned circumstances. It is an object of the present invention to provide an apparatus and method for winding a wire, which is simple in structure and in which spring of the wire out of an annular guide is prevented by accommodating a cut terminal portion of the wire in

the annular guide which is movable toward one end of a take-up bobbin.

In the apparatus for winding a wire according to the present invention, the annular guide is disposed so that it covers one of the collars of the take-up bobbin for the wire. The annular guide has a notch for guiding the wire and an inner peripheral surface having an inner diameter gradually increasing in a direction remote away from the bobbin. The annular guide can be formed in the shape having an engagement portion for preventing the spring of the wire out of the bobbin. The annular guide is disposed above the collar so that it is movable in an axial direction of the bobbin, or the annular guide may comprise a plurality of portions, which are moved to form the annular guide above the collar. Furthermore, the apparatus may comprise a wire positioning device which guides the cut terminal portion of the wire. The wire positioning device comprises a guide rod for moving the wire and a guide plate for preventing the spring of the wire.

The method of winding a wire according to the present invention may comprise winding a wire on a take-up bobbin and guiding a cut terminal portion of the wire to a notch of an annular guide which covers one of the collars of the take-up bobbin when winding of the wire is completed. Then, the cut terminal portion of the wire is guided to

the outside of the take-up bobbin along the inner peripheral surface of the annular guide having a diameter which gradually increases in a direction remote away from the bobbin, or alternatively it is engaged with an engagement portion provided on the annular guide by the centrifugal force due to the rotation of the take-up bobbin. To reach the status, the annular guide is moved to cover one of the collars of the bobbin when the winding of the wire is completed.

According to the present invention, the annular guide which is disposed so that it is capable of covering one of the collars of the take-up bobbin enables to introduce the cut terminal portion of the wire to the outside of the fully-wound wire in a simple structure or to accommodate it in a given engagement portion. As a consequence, the generation of the wire whipping by the cut terminal portion can be prevented and damages of the fully-wound wire surface can be avoided. If the wire is an optical fiber, deteriorating of the characteristics of the wound optical fiber can be avoided.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a view showing a conventional treatment of the cut terminal wire when winding of the wire is completed;

Fig. 2 is a view showing a conventional winding apparatus;

Fig. 3 is a view explaining the summary of an embodiment of a winding apparatus according to the present invention;

Fig. 4 is a view explaining the summary of another embodiment of a winding apparatus according to the present invention;

Figs. 5A through 5C are views explaining other examples of the embodiment shown in Fig. 4;

Figs. 6A and 6B are views explaining another example of the annular guide of the winding apparatus according to the present invention;

Figs. 7A and 7B are views explaining other examples of the annular guide of the winding apparatus according to the present invention;

Fig. 8 is a view explaining another example of the annular guide of the winding apparatus according to the present invention;

Fig. 9 is a view as viewed from above, explaining an operation for switching the winding of the wire according to the present invention;

Fig. 10 is a view as viewed from a lateral position, explaining an operation for switching the winding of the wire according to the present invention; and

Fig. 11 is a view showing the winding apparatus of

the present invention when the operation of Fig. 10 for switching the winding of the wire is reversed.

PREFERRED EMBODIMENT OF THE INVENTION

The summary of an embodiment of the present invention will be described with reference to Figs. 3, 4, and 5A through 5C. Fig. 3 is a view explaining an example in which the cut terminal portion of a wire is guided to the outside of a take-up bobbin; Fig. 4 is a view explaining an example in which the cut terminal portion of the wire is engaged with the engagement portion of the annular guide; Fig. 5A is a view showing another example; Figs. 5B and 5C are views explaining other examples of the engagement portion of the annular guide. In the drawings, reference numerals 20a, 20b, 20c and 20d denote annular guides; 21 an opening; 22 a side wall; 23 an outer peripheral wall; 24 a notch; 25 an inner peripheral surface; and 26 an engagement portion. Since the other reference numerals which are identical to those used in Figs. 1 and 2 denote identical parts, description thereof will be omitted.

As described in Fig. 2, the apparatus for winding a wire comprises a drive shaft 8 provided with a catcher wheel 4 which rotates together with the drive shaft 8 and is fitted to a collar 3a on one side of the take-up bobbin 3 as shown in Fig. 3. The take-up bobbin 3 is

biased from the side opposite to the drive shaft 8 by a pressing cone 9, rotatably mounted on the drive shaft 8 and, for example, rotated counterclockwise as viewed from the right.

An annular guide 20a is disposed, for example, on the take-up bobbin 3 on the side when the take-up bobbin 3 is mounted on the drive shaft 8, so that the annular guide 20a is movable in an axial direction. The annular guide 20 is formed in the ring shape. The outer peripheral wall 23 is tapered in shape so that the diameter of the inner peripheral surface 25 gradually increases in a direction toward the side opposite to the bobbin 3. The annular guide 20a is formed on the side close to the take-up bobbin 3 with an opening 21 having such a diameter through which the catcher wheel 4 can pass and is formed with the notch 24 for guiding the wire. For example, when the wire is wound, the annular guide 20a is located outside of the catcher wheel 4 and the collar 3a as represented by a dot and dash line. However, when the wire is cut as described later, the annular guide is moved in an axial direction so as to cover the catcher wheel 4 and the collar 3a just before the cut. It should be noted that the annular guide 20a is movable in an axial direction, but is irrotational.

When a predetermined length of wire is wound on the take-up bobbin 3 in the thus formed winding apparatus,

the wire 1 is cut so that the cut terminal portion (hereinafter referred to as "cut terminal wire 1a") which has been just cut becomes a free state. Due to the rotation of the take-up drum 3, the cut terminal wire 1a (about 0.5 m in length) in the free state is guided into the notch 24 formed on the annular guide 20a on the side of bobbin and is drawn into the annular guide 20a.

The cut terminal wire 1a (broken line) which is retracted into the annular guide 20a is moved by the centrifugal force due to the rotation of the take-up bobbin 3 along the inner peripheral surface 25 which is tapered so that its diameter increases in a direction away from the bobbin and the cut terminal wire 1a is subsequently discharged from the take-up bobbin 3. As a result, even though the cut terminal wire 1a (solid line) which is discharged from the take-up bobbin 3 is swung in a space around the drive shaft 8. However, the cut terminal wire will not impinge upon the surface of the wound wire 1b, and the wire whipping can be avoided. When the wire is wound, the annular guide 20a is in a retracted position. Only when the terminal wire is treated, it is moved. Accordingly, the annular guide 20a will not interrupt the winding operation and insertion and removal of the take-up bobbin 3 can be easily conducted.

Fig. 4, 5A through 5C are views explaining an example

in which the annular guide has an engagement portion its inside which engages with the cut terminal portion. Similarly to the example of Fig. 3, the annular guide 20b which is shown in Fig. 4 has on the bobbin side an opening 21 having such a diameter through which the catcher wheel 4 can pass and is provided with a notch 24 for introducing and guiding the cut terminal wire 1a. The annular guide 20b comprises on the drive shaft side opposite to the take-up bobbin a side wall 22 through which the drive shaft 8 can pass.

The outer periphery of the annular guide 20b is, for example, formed with an outer peripheral wall 23 which has an inverted V shape. The inner peripheral surface 25 of the outer peripheral wall 23 has a diameter which gradually increases from the opening 21 side to the side wall 22 side of the annular guide 20b, that is, in a direction away from the take-up bobbin. The apex of the inner peripheral surface where the diameter is maximized constitutes an engagement portion 26 which holds and engages with the wire. Similarly to the example in Fig. 3, the annular guide 20b is located outside of the catcher wheel 4 and the collar 3a when the wire is wound as represented by a dot and dash line. However, when the wire is cut, the Annular guide 20b is moved in an axial direction as represented by an arrow just before the cut so as to cover the catcher wheel 4 and the collar 3a.

The annular guide 20c shown in Fig. 5A is disposed on the opposite side of collar 3a having no catcher wheel 4. In this case, it is possible to make the diameter of the annular guide smaller in comparison with that in Fig. 4, so that the guide itself can be made more compactly.

The annular guide 20d shown in Fig. 5B has the outer peripheral wall 23 whose cross section surface inclines to one side and the inner peripheral wall 25 having a diameter which gradually increases in an outer direction away from the inner side (bobbin side) of the annular guide 20d. In this example, the engagement portion 26 is located at the outer end of the outer peripheral wall 23. Alternatively, the engagement portion 26 may be formed by providing a plurality of tongue-like pieces at the outer end of the outer peripheral wall 23 in lieu of providing the side wall 22 as shown in Fig. 5C.

Figs. 6A through 7B are views showing the other examples of the annular guide according to the present invention. Figs. 6A and 6B are views showing an annular guide comprising two halves which are slidable. Figs. 7A and 7B are views showing examples in which an annular guide comprises two halves which can be connected to each other. In the drawings, reference numerals 20e, 20f, 20g denote annular guides; 30a, 30b denote slidable semi-annular members; 31a, 31b denote connectable

semi-annular members; and 31c denotes a pivot hinge. Since the other numerals which are identical to those used in Figs. 3 and 4 denote identical parts, description thereof will be omitted herein.

The annular guide 20e shown in Figs. 6A and 6B, for example, has a V-shaped section which is shown in Fig. 4 and comprises two semi-annular members 30a, 30b which are slidable to each other along an arc. The annular guide 20e covers one of the collars 3a of the take-up bobbin 3 (for example, the collar on which the catcher wheel 4 is disposed) and has a notch 24 for introducing and guiding the cut terminal wire.

Two semi-annular members 30a, 30b are mounted so that they are slidable to each other along an arc. During winding of the wire, both member overlap each other as shown in Fig. 6A so that a half of the collar 3a is exposed and they will not hinder the winding of the wire. When the winding of the wire is completed and the wire is to be cut, one of the semi-annular members (for example, 30b) is slid along an arc, closed in the form of the ring with another semi-annular member (for example, 30a), and covers one of the collars 3a of the take-up bobbin, as shown in Fig. 6B. When the wire is being wound just before the completion of the winding of the wire, one of the collars is covered with one of the semi-annular members.

By bringing the arrangement of the semi-annular members of Fig. 6A into the ring arrangement of the semi-annular members of Fig. 6B, the annular guide comprising the engagement portion for preventing the spring of the wire can be disposed around one of the collars of the take-up bobbin similarly to the case of Fig. 4. In the arrangements of Figs. 6A and 6B, the annular guide may be placed from the side of the take-up bobbin, or may be fixed.

The annular guide 20f shown in Fig. 7A has, for example, a V-shaped section shown in Fig. 4 and comprises two semi-annular members 31a, 31b which are connectable to each other. A term "connectable" means that two semi-annular members 31a, 31b can be in the form of a ring by abutting the opposite ends of the member to each other. Two semi-annular members 31a, 31b are formed in substantially same shape and size. One of the semi-annular members is provided with a notch 24 for introducing and guiding the cut terminal wire.

The two semi-annular members 31a, 31b are separated and independent to each other and are disposed so that they cover one of the collars 3a of the take-up bobbin 3. During the winding of the wire, they are away from the take-up bobbin 3 so that they will not hinder the winding of the wire. When the winding of the wire is completed and the wire is to be cut, both the semi-annual

members 31a, 31b are moved to form a ring so that they cover one of the collars 3a.

The annular guide 20g shown in Fig. 7B comprises two semi-annular members 31a, 31b having the same size and shape which are shown in Fig. 7A which are connected by a pivot hinge 31c and can be closed and opened. In this case, the annular guide 20g is also provided with a notch 24 for introducing and guiding the cut terminal wire on one of the semi-annular members and is disposed to cover one of the collars 3a of the take-up bobbin 3. During winding of the wire, the semi-annular member 31b is away from the take-up bobbin 3 so that it will not hinder the winding of the wire. When the winding of the wire is completed and the wire is to be cut, both the semi-annular members 31a, 31b are moved to form a ring so that they cover one of the collars 3a.

Similarly to the case of Fig. 4, the annular guide having the engagement portion for preventing the spring of the wire can be disposed around the periphery of one of the collars of the take-up bobbin by closing two semi-annular members 31a, 31b so that they form a ring. The structure of Figs. 7A and 7B may be so that one of the semi-annular members 31a is fixed.

Fig. 8 is a view showing another example of the annular guide. In the drawing, a reference numeral 20h denotes an annular guide. Since reference numerals which are

identical to those in Figs. 3 and 4 denote identical parts, description thereof will be omitted herein. The illustrated annular guide 20h is identical in shape and structure to that shown in Fig. 4 and has identical V-shaped engagement portion, except that the notch 24 for introducing and guiding the cut terminal wire has a larger width and length.

The structure of Fig. 8 enables the annular guide 20h to normally cover one of the collars 3a of the take-up bobbin 3 while the wire is wound. In other words, it is possible to use the annular guide 20h while it is completely fixed. If the notch 24 is excessively large (for example, more than one quarter of the circumference), the cut terminal wire 1a will spring externally, so that there is the danger that the cut terminal wire can not be retained by the engagement portion 26 of the annular guide 20h. However, if the notch 24 is excessively small in size, there is the danger that the wire may contact with the notch, which gives the damage to the wire due to the fact the winding diameter of the wire 1b changes.

In the winding apparatus which is formed as shown in Figs. 4 through 8, for example, in the example of Fig. 4, when a predetermined length of wire is wound on the take-up bobbin 3, the wire is cut and the portion of the cut terminal wire 1a is brought into a free state. The cut terminal wire 1a which has been in a free state (a

length of about 0.5 m) is guided into the notch 24 formed in the annular guide 20b on the bobbin side and is drawn into the annular guide 20b by the rotation of the take-up drum 3.

The cut terminal wire 1a which has been drawn into the annular guide 20b is moved into the engagement portion 26 located on the apex of the V-shape of the outer peripheral wall 23 along the inner peripheral surface 25 which is formed so that its inner diameter increased in a direction away from the bobbin by the centrifugal force caused by the rotation of the take-up bobbin 3. Since the cut terminal wire 1a which has been moved to the engagement portion 26 has an increased arc diameter, it is not moved and retained within the annular guide 20b while the take-up bobbin 3 is rotated.

As a result, whipping of the wire 1b on its surface with the cut terminal wire 1a due to the fact that the cut terminal wire 1a is sprung out from the annular guide 20b can be positively prevented. During the winding of the wire, the annular guide 20b is in a retracted position, and moved only when the terminal wire is treated. Thus, the annular guide 20b will not hinder the winding of the wire, so that insertion and removal of the take-up bobbin 3 can be easily conducted. It should be noted, although the annular guides having a V-shaped section have been explained with reference to Figs. 6A, 6B, 7A and 7B, the

present invention may be applied to the annular guide comprising two halves having a tapered section as shown in Fig. 3.

Figs. 9 through 11 are views explaining the switching operation of the winding of a wire in the winding apparatus of the present invention, which will be described with reference to an example of the annular guide which is in the form shown in Fig. 4. Fig. 9 is a view as viewed from above. Figs. 10 and 11 are views as viewed from lateral side. In the drawings, reference numerals 20, 27 and 28 denote an annular guide, guide rod and guide plate, respectively. Since the other identical reference numerals denote parts having identical functions, description thereof will be omitted. One of the take-up bobbins which is to be started for winding the wire (a take-up bobbin which is located on the left side in the drawing) is annexed with an apostrophe " ' ".

If a predetermined length of wire has been wound counterclockwise on the right side take-up bobbin 3 and the winding of the wire is switched to a left side empty take-up bobbin 3' as shown in Figs. 9 and 10, the rotation of the left side take-up bobbin 3' is started and the traverse roller 2 is moved in a left direction. The right side take-up bobbin 3 is moved from a winding position which is represented by a dot and dash line to a switched

position which is represented by a solid line (Fig. 9). Just before the movement of the take-up bobbin 3 to the switched position is completed, the guide rod 27 goes down (Fig. 10) for shifting the path line D of the wire 1 to the path line E. The annular guide 20 is moved to cover the catcher wheel 4 and the collar 3a and the wire 1 is guided so that it is linearly moved across the notch 24 of the annular guide 20.

Subsequently, the left side wire moving arm 5′ is moved to bring the wire 1 into a contact with the catcher wheel 4′ of the left side empty take-up bobbin 3′ (Fig. 9). At this time, the right side wire moving arm 5 positions the wire 1 so that the path line of the wire 1 will not change. Contact of the wire 1 with the catcher wheel 4′ of the left side empty take-up bobbin 3′ enables the catcher 6′ provided on the catcher wheel 4′ to engage with the wire 1 by the clockwise rotation of the take-up bobbin 3′. Continued rotation of the take-up bobbin 3′ enables the wire 1 to be cut by the cutter 7′ (Fig. 10).

After the wire 1 has been cut, the wire moving arm 5′ returns to its original position and winding of the wire on new take-up bobbin 3′ is started. On the other hand, the right side take-up bobbin 3 which completes winding is caused to stop its rotation. However, the rotation of the take-up bobbin 3 can not be immediately stopped due to its inertia, and is continued for a short

period of time while it is decelerated. Although the cut terminal wire 1a is swung around the take-up bobbin 3 in a free state by the rotation thereof, the cut terminal wire 1a is moved out of the wound wire as shown in Fig. 3, or is guided to and retained at the engagement portion in the annular guide as described with reference to Fig. 4.

Fig. 11 is a view showing an operation for switching the winding of the wire on the left side take-up bobbin 3' which has wound a predetermined length of wire to the winding of the right side empty take-up bobbin 3 by reversing the state shown in Fig. 10. In this case, the switching operation in Fig. 11 is identical with that shown in Figs. 9 and 10. The rotation of the right side take-up bobbin 3 is started and the traverse roller 2 is moved in a right direction. Just before the movement of the left side take-up bobbin 3' to the switched position is completed, the guide rod 27' goes down for shifting the path line D of the wire 1 to the path line E. The annular guide 20' is moved to cover the catcher wheel 4' and the collar 3a' and the wire 1 is guided linearly across the notch 24' of the annular guide 20'.

After the wire 1 is engaged by the catcher 6 of the catcher wheel 4 on the take-up bobbin 3 side and is cut by the cutter 7, the wire moving arm 5 is returned to its original position and winding of the wire on new

take-up bobbin 3 is started. On the other hand, at the left side take-up bobbin 3′ which has completed winding, the cut terminal wire 1a is guided into and retained in the annular guide 20′ similarly to the case in Fig. 10.

In the present invention, a wire positioning device which guides the cut terminal portion of the wire 1 into the notches 24, 24′ is disposed in the vicinity of the annular guides 20, 20′ as mentioned above. The wire positioning device may comprise, for example, circular cylindrical guide rods 27, 27′ which are movable in a downward direction so as to face guide plates 28, 28′ which is movably disposed in the vicinity of the notches 24, 24′ of the annular guides 20, 20′. The guide rods 27, 27′ are movably disposed in a direction parallel with the axis of the take-up bobbin so that they can be retracted when they intersect with the path line D of the wire 1. The guide plates 28, 28′ may be fixedly disposed if they will not hinder the winding of the wire.

The guide rods 27, 27′ are preferably provided with wear resistance, sliding ability and mold release characteristics, for example, by subjecting the surface of aluminum or aluminum alloy to a Tufram treatment (treatment for impregnating hard anodized aluminum with Teflon (trademark)). If the wire 1 is an optical fiber, the guide rods having at a contact an arc which is larger than a minimum allowable bent radius of the optical fiber

to be wound are used. It should be noted that the guide rods 27, 27′ may be rotatable structure, or non-rotatable fixed structure.

Provision of thus formed wire positioning devices enables the wire 1 to be positively guided to the vicinity of the notches 24, 24′ of the annular guide 20. Spring of the cut terminal wire 1a outside is suppressed by introducing the terminal wire 1a which has been just cut into a small space between the guide rod 27 and the guide plate 28 for preventing the cut terminal wire 1a from impinging upon the peripheral obstacle or projections. Since the cut terminal wire 1a is effectively guided from the notches 24, 24′ to the annular guides 20, 20′ by means of the guide rods 27, 27′ and the guide plates 28, 28′, the size of the notch 24 can be made smaller. Therefore, the second spring of the cut terminal wire 1a which has been accommodated in the annular guides 20, 20′ once from the notches 24, 24′ can be positively prevented.